Helium Target: current happenings

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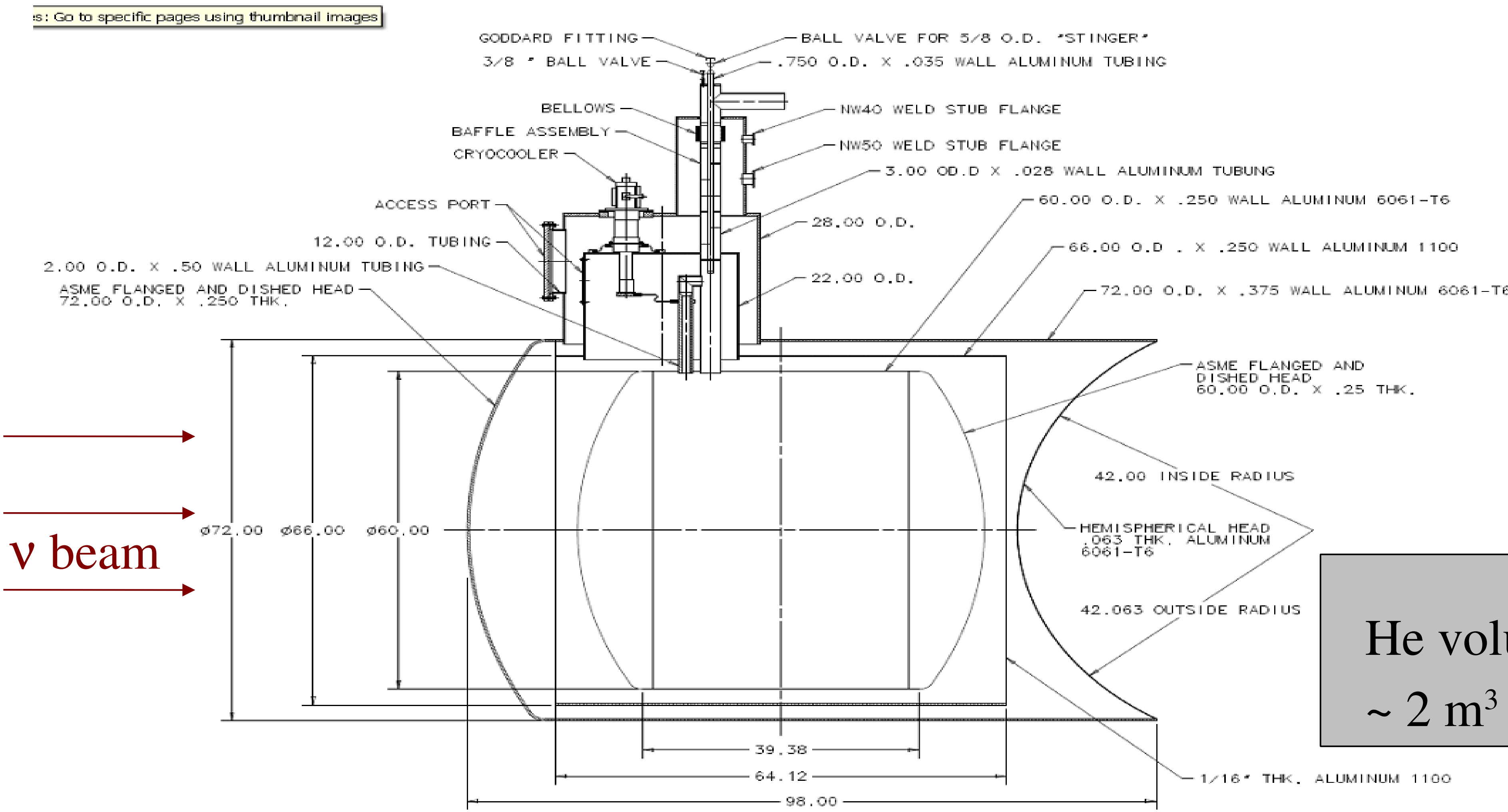
Current Design (from Richard Schmidt)



He volume

~ 2 m^3

- *Fill chimney, cryocooler moved upstream to minimize material seen by exiting particles.*
- *Minimized all material downstream, while keeping inner vessel close to MINERvA for accept.*
- *Most recent design work focusing on cryostat thermal design.*

Recent design work focus:

- Heat shield
- Heat exchanger - See doc-2057-v2
- Cryo fill chimney
- Cool down of inner vessel
- Write vessel specification

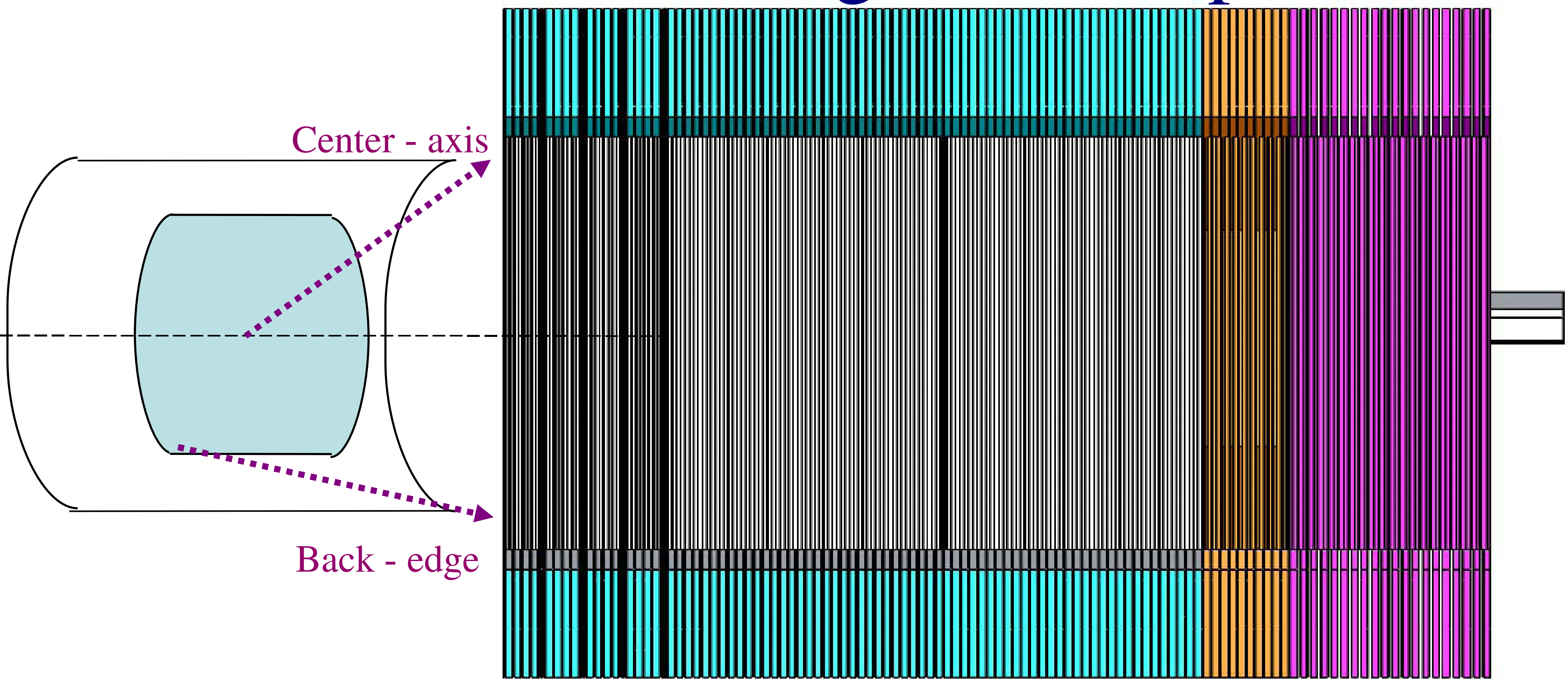
- Needed to finalize bid package

From 11/15/07 talk by Robert Sanders Doc2057-v2

Further Tasks(ongoing)

- Calculate heat through shield and inner vessel supports.
- Summarize calculations for the total heat load inner vessel.
- Complete a thermal analysis of the radiation baffles in the cryostat chimney to determine steady state heat load through the chimney.
- Redesign and redraw the chimney area of target.
- Add support feet to specification drawing
- Write bid package specifications

Geometric Angular Acceptance



θ_{max} (deg) :

	Axis	Edge
Front:	70	38
Center:	50	16
Back:	36	10

Assumes 35 cm from front target face to first plane, 1.1m length and 0.75 m radius

Trade-off between angular acceptance and downstream thickness.
=> can make inner vessel heads thinner if spherical instead of elliptical.

DIS Acceptance Studies

MC studies by Elaine Schulte

- Generated uniform beam spectrum 1-15 GeV
- 5K mixed NC and CC inclusive DIS events
- Current study utilizing older target geometry – will be updated
- Study acceptance in different x-Q^2 bins below and
- 3 sections along target length.

Upstream Third:

	$x<0.1$ GeV/c	$0.1<x<0.3$ GeV/c	$0.3<x<0.5$ GeV/c	$0.5<x<0.7$ GeV/c	$x>0.7$ GeV/c
$Q^2<1$ GeV/c^2	✔	✔	✔	✚	✚
$1<Q^2<3$ GeV/c^2	✘	✔	✔	✚	✚
$3<Q^2<5$ GeV/c^2	✘	✘	✔	✔	✚
$5<Q^2<8$ GeV/c^2	✘	✘	✘	✚	✚
$Q^2>8$ GeV/c^2	✘	✘	✘	✚	✚

√ Full acceptance
♦ Partial acceptance
X Not analyzed

Central Third:

	$x<0.1$ GeV/c	$0.1<x<0.3$ GeV/c	$0.3<x<0.5$ GeV/c	$0.5<x<0.7$ GeV/c	$x>0.7$ GeV/c
$Q^2<1$ GeV/c^2	✔	✔	✔	✚	✚
$1<Q^2<3$ GeV/c^2	✘	✔	✔	✔	✚
$3<Q^2<5$ GeV/c^2	✘	✘	✔	✔	✚
$5<Q^2<8$ GeV/c^2	✘	✘	✘	✔	✚
$Q^2>8$ GeV/c^2	✘	✘	✘	✔	✚

Results from MC

<u>Tracked to generated particle tracks in MINERνA</u>

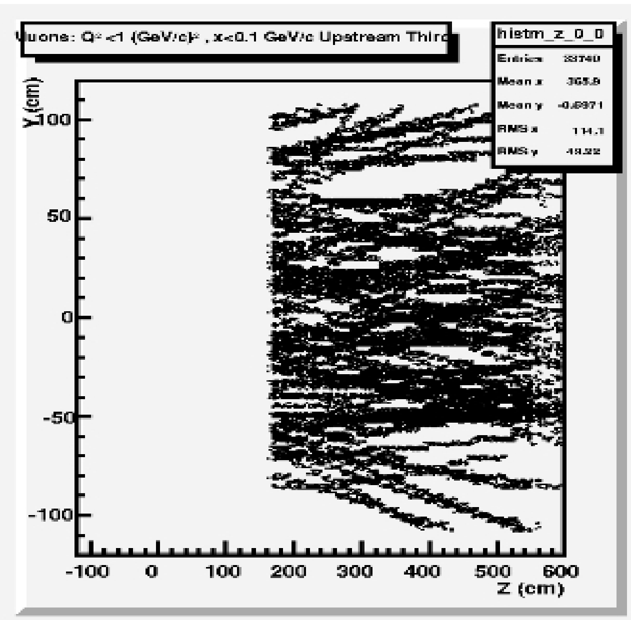
Ratio Hits/Total	muons	muons+	protons	pions			kaons	gammas
					pi+	pi-		
Upstream	0.65		0.5	0.37	0.37	0.37		
Central	0.7		0.55	0.41	0.42	0.41		
Downstream	0.88		0.86	0.71	0.71	0.69		

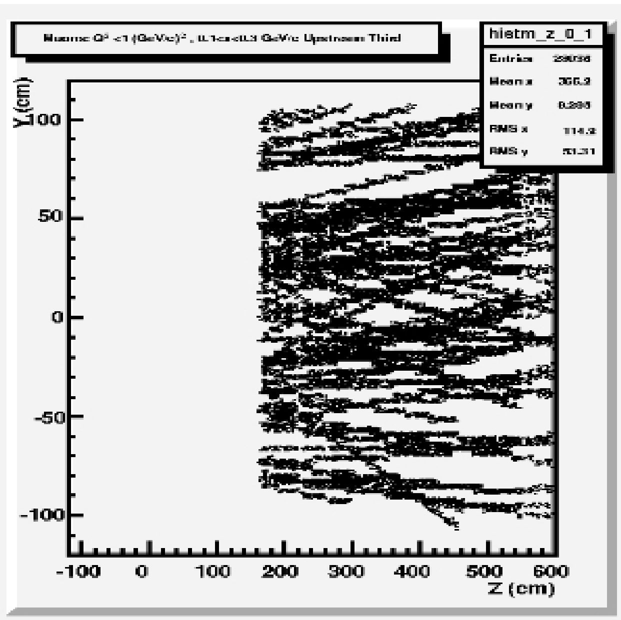
Larger hadron loss mainly due to large energy loss in target creating too few hits.

=> Many 'short tracks' (producing hits in less than 12 planes)

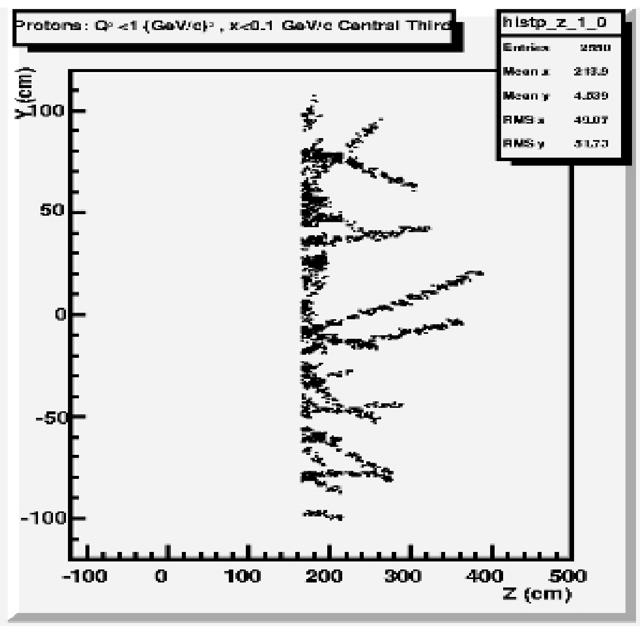
=> poorer vertex reconstruction

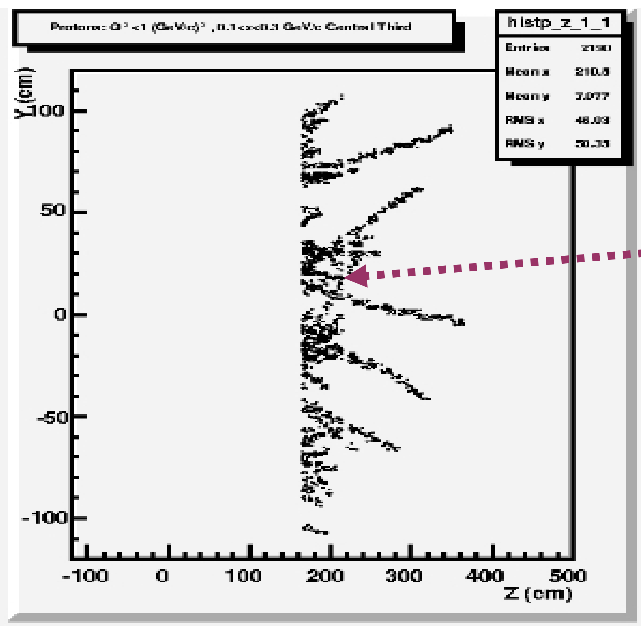
Short tracks





Long tracks for muons in this kinematic range, but can *not* determine charge without MINOS

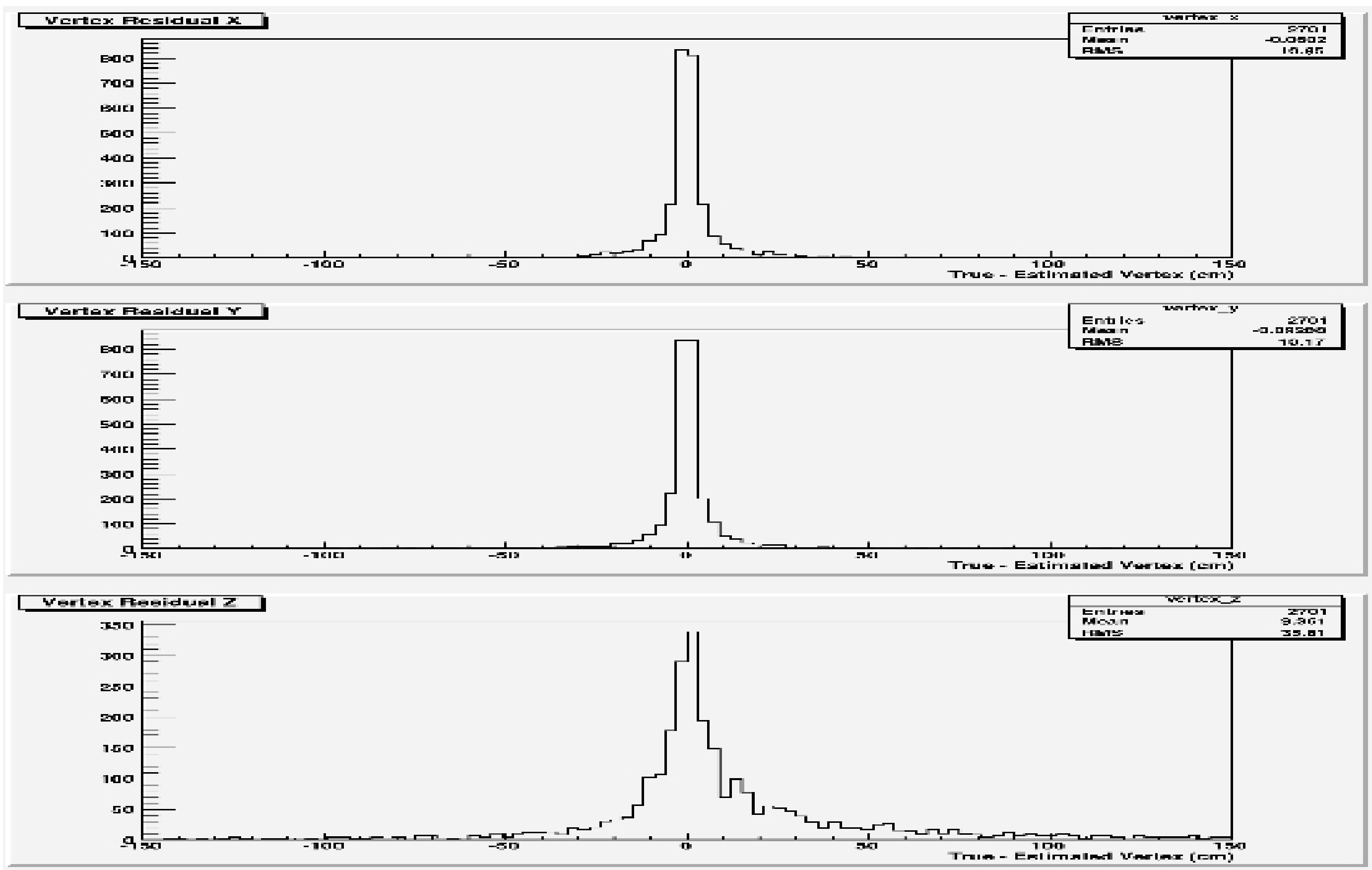




First nuclear target, many low-E hadrons range out .

=> Moving nuclear targets downstream somewhat could help considerably, or....

Vertex Reconstruction



- Reconstruction for 2-track events is not unreasonable.
- Will improve with better tracking algorithm.
- Long tails in z-vertex make isolation of He events problematic.

Add drift chambers between outer vessel and first MINERνA plane.?

Possibly utilize chambers from SOS spectrometer in JLab Hall C.

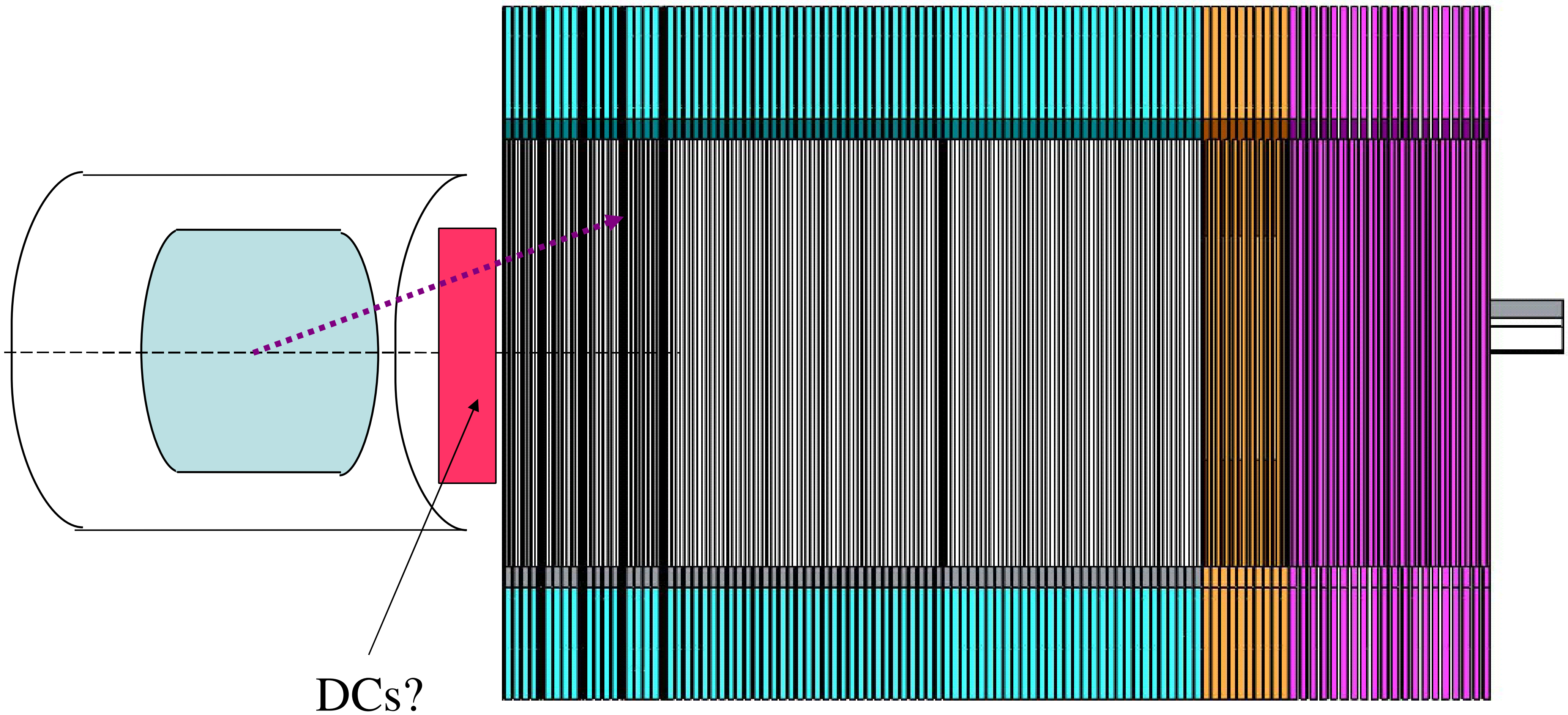
Would allow:

1) good tracking for even 'short track' charged hadrons
2) excellent determination of which events with charged tracks originate in He target
3) Much better vertex reconstruction for these events.

SOS DC configuration

2 chambers with 6 wires each (2X, 2Y, and 2U orientations)

active area of each chamber ~60 cm x 40 cm => place side by side, 60 cm x 80 cm


DCs?

Items on the MC to do list

- Update target geometry.
- Estimate x and Q2 distributions.
- Understand discontinuities in tracks.
- Improve tracking technique.
- Study kinematic resolution for various event types.